

CLAIMS

I claim:

1. A mine roof bolt comprising:
 - (a) a shaft portion having machine threads on one end of said shaft;
 - (b) a camming nut located in a fixed longitudinal location with respect to the end of said shaft; and
 - (c) an expansion shell having a threaded nut with a plurality of wedge fingers extending from the outer perimeter of said threaded nut, said wedge fingers being generally parallel to the axis of said threaded nut.
2. The mine roof bolt of Claim 1 wherein said expansion shell features two said wedge fingers extending from the outer perimeter of said threaded nut.
3. The mine roof bolt of Claim 2 wherein said threaded nut features a reduced cross-section in the portions of said threaded nut which do not feature wedge fingers attached thereto.
4. The mine roof bolt of Claim 1 wherein said expansion shell features three said wedge fingers extending from the outer perimeter of said threaded nut.
5. The mine roof bolt of Claim 4 wherein said threaded nut is notched in its circumference at the portions of said threaded nut which do not feature wedge fingers attachments.

6. The mine roof bolt of Claim 1 wherein said expansion shell features four said wedge fingers extending from the outer perimeter of said threaded nut.
7. The mine roof bolt of Claim 1 wherein said expansion shell features greater than four said wedge fingers extending from the outer perimeter of said threaded nut.
8. The mine roof bolt of Claim 1 wherein the circumference of said camming nut tapers from a larger circumference on a first end to a smaller circumference on a second end, said smaller end directed toward said expansion shell.
9. The mine roof bolt of Claim 8 wherein said camming nut features machine threads in its inner diameter, and wherein said camming nut is fixed in position by threading it onto said machined threads of said shaft portion of said roof bolt and turning said camming nut down to where the machine threads on said shaft portion end.
10. The mine roof bolt of Claim 8 wherein said camming nut is fixed in position by crimping it onto said shaft portion.
11. The mine roof bolt of Claim 8 wherein said camming nut is fixed in position by welding it to said shaft portion.

12. The mine roof bolt of Claim 8 wherein:
 - (a) said shaft portion has a smaller diameter at said machine thread end and a larger diameter at the opposite end and a tapered transition section between said smaller and said larger diameter, and
 - (b) said camming nut is held proximate said machine threads by having an inner diameter greater than said smaller diameter of said shaft but less than said larger diameter of said shaft and being placed in said tapered transition section.
13. The mine roof bolt of Claim 1 wherein said camming nut is held in said longitudinal location about said shaft portion by a support washer.
14. The mine roof bolt of Claim 13 wherein said support washer features machine threads in its inner diameter, and wherein said support washer is fixed in position by threading it onto the machined threads of said shaft portion of said roof bolt and turning it down to where the machine threads on said shaft portion end.
15. The mine roof bolt of Claim 13 wherein said support washer is fixed in position by crimping it onto said shaft portion.
16. The mine roof bolt of Claim 13 wherein said support washer is fixed in position by welding it to said shaft portion.

17. The mine roof bolt of Claim 13 wherein:

- (a) said shaft portion has a smaller diameter at said machine thread end and a larger diameter at the opposite end and a tapered transition section between said smaller and said larger diameter, and
- (b) said support washer is held proximate said machine threads by having an inner diameter greater than said smaller diameter of said shaft but less than said larger diameter of said shaft and being placed in said tapered transition section.

18. The mine roof bolt of Claim 1 wherein:

- (a) said camming nut features a number of flat sides corresponding to at least the number of wedge fingers on an said expansion shell, and
- (b) said camming nut tapers from a larger end to a smaller end, said smaller end directed toward said threaded end of said shaft portion.

19. A mine roof bolt comprising:

- (a) a shaft portion having machine threads on one end;
- (b) an expansion shell having a threaded nut with a plurality of individual bails extending from said threaded nut generally parallel to the axis of the said threaded nut, said expansion shell being threaded onto said shaft portion;
- (c) a wedge attached at the end of each said individual bails; and
- (d) a camming nut fixed in a longitudinal location on said shaft portion proximate

to said machine threads and said wedges.

20. The mine roof bolt of Claim 19 wherein said expansion shell features two said bails extending from said threaded nut.
21. The mine roof bolt of Claim 20 wherein said threaded nut features a reduced diameter in the portions of said threaded nut which do not feature bails attached thereto.
22. The mine roof bolt of Claim 19 wherein said expansion shell features three said bails extending from said threaded nut.
23. The mine roof bolt of Claim 22 wherein said threaded nut is notched in its circumference at the portions of said threaded nut where said bails are not attached.
24. The mine roof bolt of Claim 19 wherein said expansion shell features four said bails extending from said threaded nut.
25. The mine roof bolt of Claim 19 wherein said expansion shell features greater than four said bails extending from said threaded nut.
26. The mine roof bolt of Claim 19 wherein said camming nut is located on said shaft portion between said threaded nut and said wedges.

27. The mine roof bolt of Claim 19 wherein said camming nut tapers from a larger circumference on a first end to a smaller circumference on a second end, said smaller circumference directed toward said wedges.
28. The mine roof bolt of Claim 19 wherein said camming nut is fixed in position by crimping it onto said shaft portion.
29. The mine roof bolt of Claim 19 wherein said camming nut is fixed in position by welding it to said shaft portion.
30. The mine roof bolt of Claim 19 wherein:
 - (a) said camming nut has a number of flat sides equal to at least the number of said bails on an associated expansion shell, and
 - (b) said camming nut tapers from a larger end to a smaller end, said smaller end directed towards said wedges on said bails.
31. The mine roof bolt of Claim 19 wherein said camming nut is held in said longitudinal location by a support washer.
32. The mine roof bolt of Claim 31 wherein said support washer is fixed in position by crimping it onto said shaft portion.

33. The mine roof bolt of Claim 31 wherein said support washer is fixed in position by welding it to said shaft portion.
34. A method of anchoring a roof bolt in the roof of an underground mine comprising:
- (a) drilling a hole into said roof of said underground mine;
 - (a) inserting into said hole, a roof bolt assembly comprised of:
 - (i) a mine roof bolt, threaded on one end,
 - (ii) a camming nut fixed in its longitudinal position proximate said threaded end of said mine roof bolt, and
 - (iii) a threaded expansion shell threaded onto said threaded mine roof bolt,
 - (b) turning said threaded mine roof bolt so as to cause said threaded expansion shell to move along said threaded mine roof bolt and engage said camming nut, and wherein said camming nut is urged into said expansion shell causing said expansion shell to open and engage the adjacent rock formations of said mine roof.
35. The method of Claim 34, wherein:
- (a) prior to inserting said mine roof bolt, frangible pouches of adhesive constituent are inserted into said hole, and
 - (b) the insertion and turning of said threaded mine roof bolt breaks said frangible pouches and mixes said adhesive constituents.

36. A method of anchoring a bolt in a bore hole comprising the steps of:
- (a) threadedly engaging to the end of the bolt for axial movement thereon, an expansion shell having a plurality of longitudinally extending fingers,
 - (b) positioning a camming nut on said bolt with the camming nut surrounded by said longitudinally extending fingers of the expansion shell on the bolt,
 - (c) preventing movement of said camming nut along the axial direction on the bolt, and
 - (d) moving said expansion shell on the bolt by rotation of said bolt to expand the fingers of said expandable shell upon the urging of said camming nut to anchor said expandable shell and said bolt connected thereto in the bore hole and applying a tension to said bolt.
37. A method of anchoring a bolt in a bore hole as set forth in claim 36 which further includes,
- (a) having a specified quantity of threads on said bolt,
 - (b) having a predetermined distance between said camming nut and said fingers, and
 - (c) turning said bolt at a selected rate such that the time required to engage said expansion shell onto said camming nut and cause, through said wedging action, said wedge fingers to expand and engage the sides of said bore hole, is predetermined.
38. A method of anchoring a bolt in a bore hole as set forth in claim 36 which includes,

positioning a frangible container of an epoxy adhesive and bonding material in the bore hole ahead of said expandable shell,
rotating said bolt within said bore hole to effect breakage of said frangible container and mixing of said epoxy adhesive material in said bore hole, and
moving said expansion shell along said bolt to expand the fingers of said expansion shell in said bore hole to anchor said bolt.

39. A method of anchoring a bolt in a bore hole as set forth in claim 38 which further includes,
- (a) having a specified quantity of threads on said bolt,
 - (b) having a predetermined distance between said camming nut and said fingers, and
 - (c) turning said bolt at a selected rate such that the time required to engage said expansion shell onto said camming nut and cause, through said wedging action, said wedge fingers to expand and engage the sides of said bore hole, is predetermined.

40. A method of anchoring a bolt in a bore hole as set forth in claim 38 which further includes,

having a specified quantity of threads on said bolt,
having a predetermined distance between said camming nut and said fingers,
turning said bolt at a selected rate such that the time required to engage said

expansion shell onto said camming nut and cause, through said wedging action, said wedge fingers to expand and engage the sides of said bore hole corresponds with the time required for said epoxy bonding material to act upon said bolt to further anchor said bolt by bonding said bolt to the surrounding rock strata.

41. A method of anchoring a bolt in a bore hole comprising the steps of:
- (a) threadedly engaging to the end of said bolt for axial movement thereon, an expandable shell having a plurality of longitudinally extending bails, each bail having a wedge affixed thereto,
 - (b) positioning a camming nut on the bolt with the camming nut surrounded by the wedges affixed to the longitudinally extending bails of the expansion shell on the bolt,
 - (c) preventing movement of the camming nut along the axial direction on the bolt, and
 - (d) thereafter moving said expandable shell on said bolt by rotation of said bolt such that said camming plug expands the wedges affixed to the longitudinally extending bails of said expandable shell to anchor said expandable shell and said bolt connected thereto in the bore hole and applying a tension to said bolt.
42. A method of anchoring a bolt in a bore hole as set forth in claim 41 which includes,
- (a) having a selected quantity of threads on said bolt, a predetermined distance between said camming nut and said wedges on said longitudinal bails, and
 - (b) turning said bolt at a selected rate,

to anchor said bolt in a desired time.